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NATIONAL ASTRONOMY AND IONOSPHERE CENTER

Reply to:
Office of the Director
Cornell University
Space Sciences Building
Ithaca, NY 14853-6801
Telephone: 607-255-3735
FAX: 607-255-8803

Arecibo Observatory
Post Office Box 995
Arecibo, PR 00613
Telephone: 809-878-2612
FAX: 809-878-1861

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To CASI p-2

Ms. Beatrise Morales
National Aeronautics and Space Administration
Ames Research Center
Moffett Field, CA 94035-1000

Dear Ms. Molares:

This letter constitutes the final Technical Report for NASA-Ames Agreement NAG2-540.

The above-referenced agreement included funding for observations of the Galactic Center Molecular Cloud Sagittarius B2 carried out with the Kuiper Airborne Observatory.

The principal investigator, Paul F. Goldsmith, participated in one flight of the Kuiper Airborne Observatory in April 1989. During the course of this flight, observations at 50 and 100 microns wavelength were carried out using the 8-beam photometer developed by D. Lester and P. Harvey of the University of Texas. The flight and the observations were extremely successful. During the reduction of data, graduate student D. Lis became involved, and this data formed a portion of his doctoral dissertation at the University of Massachusetts, Amherst.

The observations of the continuum emission from the Sagittarius B2 Molecular Cloud core were deconvolved using a 1-dimensional maximum entropy technique to produce images with angular resolutions of 20 arcseconds by 7 arcseconds at 50 microns wavelength, and 28 arcseconds by 10 arcseconds at 100 microns wavelength. We were able to establish that the northern source Sgr B2(N) has a flux density of only 1.5 kJy at 50 microns, compared to 4.3 kJy for Sgr B2(M), the "main" source. These observations provided critical proof of previous models which suggested an extremely large extinction in front of the northern source. The foreground cool dust greatly reduces the emission from the northern source. We were also able to verify the total luminosity of the region to be 1-2 $\times$ 10^7 solar luminosities.

In these observations, and as a result of the maximum entropy deconvolution, Sagittarius B2(N) and Sagittarius B2(S) were detected as separate sources for the first time in the far-infrared region. In addition to the compact source mapping, we found evidence for a significant spatially

extended component of the far-infrared emission at both wavelengths. Its angular extent is approximately 1 arcminute by 2 arcminutes, or 2.25 by 4.5 parsecs at the distance of the galactic center. Its approximately spatial co-extensiveness with a low level extended component of the radio-free emission and with the dense central core of the Sgr B2 region determined by molecular observations to have $\geq 10^5$ hydrogen molecules per cubic centimeter, suggests that the ionizing radiation from the massive stars in the compact sources diffuses through a region with a beam-average visual extinction greater than or equal to a few hundreds of magnitudes. This result strongly implies that the gas and the dust in the central portion of the cloud surrounding the compact radio-free-far-IR sources are highly clumped.

In addition to providing a basis for the PhD dissertation mentioned above, the results from this flight resulted in publication of an article "High Angular Resolution Far-Infrared Observations of Sagittarius B2" by P.F. Goldsmith, D.C. Lis, D.F. Lester, and P.M. Harvey, in the *Astrophysical Journal,* 389, 338-346, 1992 April 10.

I hope this completes the requirements for technical reporting, and I apologize for the lengthy delay caused by my changing academic affiliation.

Yours sincerely,

Paul F. Goldsmith
Director, NAIC
Professor of Astronomy

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